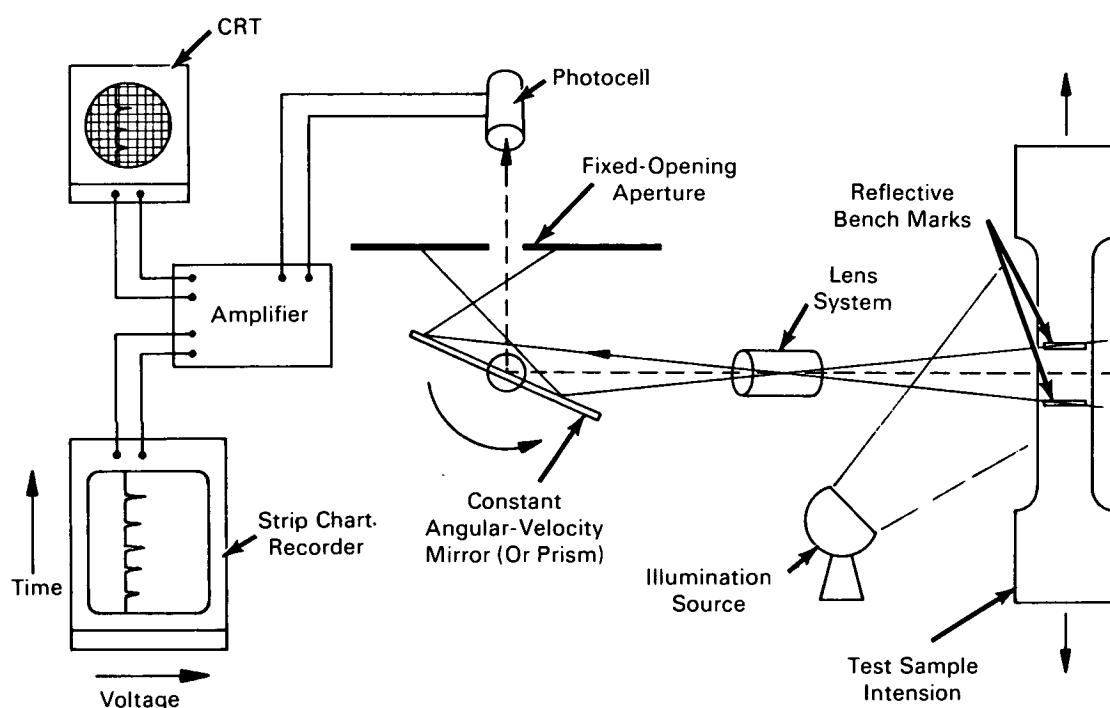


NASA TECH BRIEF



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Noncontacting-Optical-Strain Device



A noncontacting-strain-measuring gauge and extensometer for remotely measuring the mechanical displacement along the entire length of a test specimen was developed. Measurement is accomplished by continuous scanning of a reflected light from reflective bench markings or stripes previously affixed to the specimen.

In this measurement the following steps are included: (1) applying reflective calibration marks to the test specimen; (2) illuminating the specimen while it undergoes displacement; (3) scanning the entire length of the specimen with a constant angular velocity

mirror or prism; (4) allowing the reflected image to fall upon a photocell with a narrow slit or aperture; (5) amplifying the output signal from the photocell; and (6) graphically displaying the resulting signal so that the distance between peaks is linearly related to actual mechanical movement during testing. A typical apparatus employing this method is shown schematically in the figure. The basic components of this device include a reflectively marked test sample, an illumination source directed toward the sample, a lens system, a constant angular-velocity mirror or prism, an aperture, a photocell with rapid response,

(continued overleaf)

an amplifier, and a readout system that may be either a cathode-ray tube or strip-chart recorder or both.

In the operation of this device, two narrow reflective strips of aluminum foil are affixed at each end of the test specimen, which is dark in color. The illumination source with reflector is positioned so as to illuminate the entire test specimen. A lens system and rotating mirror are set in place and serve to direct reflected light from the specimen to the photocell which has a slit-like aperture. A constant-speed motor provides the rotating motion for the mirror. An electrical amplifier and strip-chart recorder convert the electrical output signal from the photocell to a graphic profile having two sharp peaks caused by reflective bench marks. The chart distance between peaks is then measured as well as the physical distance separating the reflective marks on the specimen itself; these data provide a calibration factor. Thereafter, as the test specimen is elongated, the scanning and readout provides a new graphic profile with a greater distance between peaks. Thus, the distance between peaks is proportional to sample movement, and gives a continuous measure of sample movement. The mirror scanning system may be replaced by a prism system. A typical scanning system with mirror or prism may be arranged to oscillate over a 10-to 120-degree arc, or alternately to rotate over a 360-degree arc. With a front and back silvered rotating mirror it is possible to achieve continuous readout. This device is not

limited to operation with a visible light source, and has been found to be operative with an infrared or ultraviolet light source.

Notes:

1. This device can be used to remotely measure changes in dimension during tests under extreme environmental conditions.
2. Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B 70-10292

Patent status:

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